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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/033,997	12/19/2001	Chris R. Franklin		1881

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EXAMINER

TSAI, SHENG JEN

ART UNIT PAPER NUMBER

2186

DATE MAILED: 10/18/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/033,997

Applicant(s)

FRANKLIN ET AL.

Examiner

Sheng-Jen Tsai

Art Unit

2186

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 19 September 2005.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-13 is/are pending in the application.
- 4a) Of the above claim(s) 2 and 5 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1,3,4 and 6-13 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

1. This Office Action is taken in response to Applicants' Request for Continued Examination (RCE) filed on September 19, 2005 regarding application 10/033,997 filed on December 19, 2001.

2. Claims 1-13 are pending in the application under consideration.

Claims 1 and 9 have been amended.

Claims 2 and 5 have been cancelled.

Claims 12-13 have been added.

3. ***Response to Amendments and Remarks***

Applicants' remarks have been fully and carefully considered with examiner's responses set forth below.

In response to Applicants' remarks and upon further consideration, the 102 & 103 rejections based on Shalit (US 5,875,457) and other references as stated in the previous Office Action have been withdrawn.

However, during the course of reconsideration, a new ground of claim analysis based on Jacobson et al. (US 5,615,352) and Verdoorn, Jr. (US 5,524,204) has been embarked. Refer to the corresponding section of claim analysis for details.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. Claims 1, 3-4 and 6-13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Jacobson et al. (US 5,615,352), and in view of Verdoorn, Jr. (US 5,524,204).

As to claim 1, Jacobson et al. disclose **a method for expanding a RAID subsystem** [Methods for Adding Storage Disks to a Hierarchic Disk array while maintaining Data Availability (title)] **from a first array of disk drives** [figures 2-3 show the first array of disk drives comprising disks 0, 1, 2 and 3] **to a second array of disk drives** [figures 5, 7-12 show the second array of disk drives comprising disks 0, 1, 2, 3 and 4], **the first array including a set of data disk drives storing old data and spare space** [figures 2-3 show the first array of disk drives of disks 0, 1, 2 and 3 storing old data; two types of "spare space" are disclosed by Jacobson et al.: the first type is the "reserved storage space" (column 11, lines 41-63), and the second type is the storage space that has not yet been designated (also referred to as the "empty space", or "unused space") in the RAID regime (column 8, lines 31-42; column 12, lines 35-43); figure 12 shows the E (Empty) areas of the disk drives], **and the second array including the first array and at least one new disk drive** [figures 5, 7-12 show the second array of disk drives comprising disks 0, 1, 2, 3 and 4, while disk drive 4 is the new disk drive], **comprising:**

Initializing the spare space to all zero data [see below];

Distributing the old data among the set of data disk drives and at least one new disk drive [figures 7-12 illustrate this process using disk drives 0, 1, 2, 3 and 4

(the new disk drive)] **while mapping new data to the spare space** [unused storage space (i.e., spare space) is used to facilitate a user's new storage request (i.e., new data to be stored in the disk drives (column 12, lines 35-43)]; **and copying, upon completion of the distribution, the new data from the spare space to the set of data disk drives and at least one new disk drive** [column 12, lines 44-55] **to enable concurrent expansion of the first array while accessing the old and new data** [column 12, lines 56-67; column 13, lines 1-5; column 16, lines 10-16].

Regarding claim 1, Jacobson et al. do not explicitly mention **Initializing the spare space to all zero data.**

However, initialization the contents of storage elements (registers, memory, disks, etc.) to zero upon a power-on or reset event is a well-known and common practice in the art (refer to Microsoft Computer Dictionary, Microsoft express, page 273 – initialize).

Further, Verdoorn, Jr. teaches in the invention "Method and Apparatus for Dynamically Expanding a Redundant Array of Disk Drives" **writing zeros to data blocks** as part of the process to support dynamically expanding a redundant array of disk drivers ["the array controller writes zeros to all physical blocks for data and parity of the M expansion DASDs" (column 5, lines 44-45). Note that the M expansion DASDs are the spare disks (see figure 1); figure 3C, items 326 and 328].

Initializing the spare space to all zero data allows the spare space to be in a predetermined state and make the calculation and the generation of the parity predictable and controllable, which is crucial to the process of RAID expansion.

Therefore it would have been obvious for persons of ordinary skills in the art at the time of applicant's invention to recognize the well-known and widely adopted practice of initializing the spare space to all zero data in supporting the RAID expansion process, as demonstrated by Verdoorn, Jr., and the lack of patentable significance of this limitation.

As to claim 3, Jacobson et al. teach that **allocating the spare space among the first array of disk drives** [the reserved storage space will typically be distributed throughout the disk array in a non-continuous manner (column 12, lines 20-23)]. Further, Applicants admit in the "Background Of The Invention" section of the Application that "spare space can either be allocated on a dedicated spare disk, or allocated in a distributed manner over all of the active disk drives of the array."

As to claim 4, Jacobson et al. teach that **the new data are mapped redundantly** [figures 7-12 show that parity (P) data is generated to be associated with each group of blocks of data].

As to claim 6, Jacobson et al. and Verdoorn, Jr. teach **generating parity data for the initialized spare space** [Jacobson et al. teach generating parity data (figures 7-12 show that parity (P) data is generated to be associated with each group of blocks of data), and Verdoorn, Jr. teaches initializing the spare space with all zero data (refer to "As to claim 1)].

As to claim 7, Verdoorn, Jr. teaches **initializing at least one new disk drive** [Verdoorn, Jr. teaches initializing the spare space with all zero data (refer to "As to claim 1)]; Jacobson et al. teach **generating parity data for the initialized new disk**

drive [figures 7-12 show that parity (P) data is generated to be associated with each group of blocks of data].

As to claim 8, Jacobson et al. discloses **determining parity for the new data from the new data and old data** [figure 3; column 6, lines 35-64].

As to claim 9, Jacobson et al. disclose **an expandable RAID subsystem, comprising:**

A first array of disk drives including a set of data disk drives storing old data and spare space [refer to "As to claim 1"];

A second array of disk drives including the first array and at least one new disk drive [refer to "As to claim 1"];

Means for initializing the spare space to all zero data [refer to "As to claim 1"];

Means for distributing the old data among the set of data disk drives and at least one new disk drive while mapping new data to the spare space [refer to "As to claim 1"]; and

Means for copying, upon completion of the distributing, the new data from the spare space to the set of data disk drives and at least one new disk drive to enable concurrent expansion of the first array while accessing the old and the new data [refer to "As to claim 1"].

As to claim 10, refer to "As to claim 1" and "As to claim 3."

As to claim 11, Jacobson et al. teach **allocating the spare space on a dedicated spare disk drive** [figure 1, 31 shows dedicated spare disk drives; further, Applicants admit in the "Background Of The Invention" section of the Application that

“spare space can either be allocated on a dedicated spare disk, or allocated in a distributed manner over all of the active disk drives of the array.”], and Verdoorn, Jr. teaches **initializing the spare space to all zero data** [refer to “As to claim 1”].

As to claim 12, Jacobson et al. disclose **a method for expanding a RAID subsystem** [Methods for Adding Storage Disks to a Hierarchic Disk array while maintaining Data Availability (title)] **from a first array of disk drives** [figures 2-3 show the first array of disk drives comprising disks 0, 1, 2 and 3] **to a second array of disk drives** [figures 5, 7-12 show the second array of disk drives comprising disks 0, 1, 2, 3 and 4], **the first array including a set of data disk drives for storing old data and containing spare space** [figures 2-3 show the first array of disk drives of disks 0, 1, 2 and 3 storing old data; two types of “spare space” are disclosed by Jacobson et al.: the first type is the “reserved storage space” (column 11, lines 41-63), and the second type is the storage space that has not yet been designated (also referred to as the “empty space”, or “unused space”) in the RAID regime (column 8, lines 31-42; column 12, lines 35-43); figure 12 shows the E (Empty) areas of the disk drives], **and the second array including the first array and at least one new disk drive** [figures 5, 7-12 show the second array of disk drives comprising disks 0, 1, 2, 3 and 4, while disk drive 4 is the new disk drive], **comprising:**

distributing the old data among the set of data disk drives and at least one new disk drive [figures 7-12 illustrate this process using disk drives 0, 1, 2, 3 and 4 (the new disk drive)] **while mapping new data to the spare space** [unused storage space (i.e., spare space) is used to facilitate a user's new storage request (i.e., new data to be

stored in the disk drives (column 12, lines 35-43)], **wherein the spare space is allocated on a dedicated spare drive of the first disk drive array** [figure 1, 31 shows dedicated spare disk drives; further, Applicants admit in the "Background Of The Invention" section of the Application that "spare space can either be allocated on a dedicated spare disk, or allocated in a distributed manner over all of the active disk drives of the array."]; and **copying, upon completion of the distribution, the new data from the spare space to the set of data disk drives and at least one new disk drive** [column 12, lines 44-55] **to enable concurrent expansion of the first array while accessing the old and the new data** [column 12, lines 56-67; column 13, lines 1-5; column 16, lines 10-16].

As to claim 13, refer to "As to claim 12."

6. **Related Prior Art**

The following list of prior art is considered to be pertinent to applicant's invention, but not relied upon for claim analysis conducted above.

- Stallmo et al., (US 5,657,468), "Method and Apparatus for Improving Performance in a Redundant Array of Independent Disks."
- Nelson et al., (US 5,666,512), "Disk array Having Hot Spare Resources and methods for Using hot Spare Resources to Store user Data."
- Lyons et al., (US 6,304,941), "Method and Apparatus for Reducing Processor operations when Adding a new Drive to a RAID-6 Drive Group."
- King et al., (US 6,530,004), "Efficient Fault-Tolerant Preservation of Data Integrity During Dynamic RAID Data Migration."

- Burkes et al., (US 5,542,065), "Method for Using Non-Contiguously Reserved Storage Space for Data Migration in a Redundant Hierarchic Data Storage System."

Conclusion


7. Claims 1, 3-4 and 6-13 are rejected as explained above.
8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Sheng-Jen Tsai whose telephone number is 571-272-4244. The examiner can normally be reached on 8:30 - 5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew Kim can be reached on 571-272-4182. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Sheng-Jen Tsai
Examiner
Art Unit 2186

October 7, 2005


PIERRE BATAILLE
PRIMARY EXAMINER